CLAIMS

I claim:

1. An integrated actuator-carriage arm and suspension system for a hard disk drive information storage system-that can be an internal or an external drive, comprising of:

a. two platters supported for rotation about an axis, and having thereon two opposite magnetic surfaces;

b. six linear stationary micro-rails, that extend from outer perimeter edge towards the center of each said disk,

c. two wing shaped actuator-carriage arms that move linearly over said micro rails;

d. an actuator member supported for movement relative to said disks and said axis, two pairs of actuators for effecting controlled parallel movements of said members on two different quarters of the disk and said axis concurrently,

e. read/write heads-where each read/write head is on the two sides of a continuous surface contact micro-pad, all supported by said actuator member for controlled precision movements in conjunction with said actuation member, movement of said member by said actuator corresponding to movement of said read/write heads adjacent and in a direction that is linear motion-tangential to data tracks, but conforming to approach angle of the arcs of said magnetic surface data tracks as a function of actuator geometry to said disk from said axis, and;

f. evenly interspaced servo write and detection head members disposed on said member, that function as position detector to generate position signals to indicate the position of said read/write heads relative to said surface of said disk, and

g. two flexible printed circuit (FPC) boards that have the wiring board connections

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which have signal lines that connect said magnetic heads and the actuators to the drive electronics board via the connection and moving members.

h. two analog voice coil motors that move the said wing shaped two pairs of actuators along two different-independent stationary linear paths of micro-rails, and;

i. said analog voice coil motors also have a digital mode-switching from analog to digital mode and back to analog-for skipping data tracks-when micro actuation is not needed.

2. The positioning and actuator-carriage arm system as set forth in claim 1, includes two wing shaped pairs of actuators; where each pair moves in unison-parallel to each other.

3. The actuator-carriage arm and suspension system as recited in claim 2, wherein said two pairs of actuators that move within their limited range-enable; the distance that each actuator member of these pairs have to cover to be a considerably shorter distance to reach different concentric tracks of the disk.

4. The actuator-carriage arm system as recited in claim 3, wherein said two pairs of actuators that are assigned to move only within a limited range, this said distance of back and forth motion is limited for each member to only 1/2 of the distance of the radius of the disk-excluding the non data zone-during operation, thereby; increases each members precision, enables several layers of programs to be loaded faster at boot up, and speeds up the external transfer rate and shortens the overall access-retrieval time of said drive.

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5. The actuator-carriage arm and suspension system as recited in claim 2, wherein the two pairs of wing shaped actuators and the series of multiple R/W heads enable sufficient excess number of R/W transducer heads; that can access a multitude of data tracks with precision that are close or adjacent and therefore an additional built in micro actuator is not needed and thereby the cost of integrating micro actuator is avoided.

6. The actuator-carriage arm and suspension system as set forth in claim 1, wherein said member wing shaped actuators are arranged; to move over two different quadrants of the disk area concurrently.

7. The actuator-carriage arm and suspension system as recited in claim 5, wherein said wing shaped actuators and the R/W heads of said second pair of actuators that are affixed to said integrated suspension of said second actuators, can have access to same set of multiple tracks; with only 1/2 revolution of the disk, when actuators are positioned symmetrically over same set of tracks and over the opposite quadrants of the disk.

8. The actuator and carriage arm and suspension system as set forth in claim 1, wherein the movement of each other pair of wing shaped actuator; is independent of the movements of the other pair of actuator.

9. The actuator-carriage arm and suspension system as recited in claim 7, wherein the said actuators, if not positioned symmetrically, a multitude of different set of tracks are accessed by the said R/W heads of the said actuators that are in an asymmetric position; with only less

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than one revolution of the disk.

10. The actuator-carriage arm system as set forth in claim 1, wherein a total of two hundred and seventy two thin film R/W heads and one hundred and thirty six (one micro-pad for two R/W heads,) or -multiples thereof- micro-pads are affixed to the wing shaped actuator-carriage arms, wherein each actuator covers 17 tracks concurrently and there are four evenly interspaced transducers for each track- thereby each member actuator of the pairs; has access in increments of one hundred and forty seven tracks per ½ concentric limited range assigned - where concurrent R/W does not have to be made using all of R/W heads at the same time and in another mode R/W is done sequentially, even as actuators remain stationary over a set of certain tracks or make micro distance re-positioning.

11. The actuator-carriage arm and integrated suspension system as recited in claim 7 and 9, wherein the arc like shaped geometry and plurality of wing shape of the actuator and the double pair configuration of said actuator arms and a series of R/W heads form an arc like path and two wings extend over and conform to the arcs of the data tracks below, thereby; enable an uninterrupted row of complete disk sectors to pass under these said R/W head members, as said R/W heads do not need to be re-positioned frequently-as in the prior art, and therefore enable a parallel data transfer scheme.

12. The actuator-carriage arm and suspension system as set forth in claim 1, wherein both pairs of the actuators and their R/W heads are connected to the drive electronics board, by flexible printed circuit (FPC) board electronic wiring connection that connects actuators and

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R/W heads to the drive electronics board, via the member that moves the pair of actuator.

13. The actuator-carriage arm and integrated suspension system as recited in claim 12, wherein; the electronic communication between actuators and R/W heads can alternatively be established with a micro-range Blue tooth technology instead of flexible printed circuit wiring.

14. The actuator-carriage arm and suspension system as set forth in claim 1, wherein the two stationary micro-rails per disk surface, facilitate linear movements of said member wing shaped actuators, that enable the R/W transducer heads of said integrated suspensions of said actuators to have a continuous contact pad and a constant fly height; that enables a unique parking feature of the heads, where the R/W heads that are affixed on the wing shaped actuator and integrated two suspension sides move within the two limited 1/2 inner range of the radius of the disk, are moved to positions-over two concentrically aligned non data zones-which are concentric rings-one located at the outer diameter-the other closer to center of the disk, thereby;

a) system is not subject to contact start stop (CSS) operation method and,

b) system is not subject to Quasi-Rigid body vibrations and relatively high vibrations due to frequent direction reversals during the boot up, scandisk, defragmentation, compression, backup and maintenance tasks-and any other tasks that involve having to reach the entire or most or data tracks that are located in different parts of the disk area.

15. The actuator-carriage arm and integrated suspension system as recited in claim 14,

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wherein the low fly height, is in the order of 0.1-0.5 micron above the disk surface.

16. The actuator-carriage arm and suspension system as set forth in claim 1, wherein the disk members have an optimal rpm of 7200 rpm in order to avoid heating.

17. The actuator-carriage arm system as set forth in claim 1, wherein the actuator arms and suspensions with multiple R/W heads, have embedded servo write-detection member heads to enable precise positioning on the disk

18. The actuator-carriage arm and suspension system as set forth in claim 1, wherein the magnetic disk members that are used to write and read information upon, have a protective wear-resistant coating-that is compatible to the micro pads-that protects the magnetic layer and creates a smooth but textured surface with low capillary adhesion-and make R/W heads-independent of air lifting of disk tangential velocity.

19. The actuator-carriage arm and integrated system as recited in claim 18, wherein the independence from air lifting of disk tangential velocity is mainly a combination of functions of the continuous contact of micro-pads, and the constant height feature provided by the stationary micro-rail.

20. The actuator-carriage arm and suspension system as recited in claim 18, wherein the protective wear-resistant layer is preferably titanium di-boride or amorphous nitrided carbon, or chromium, or tungsten and the disk surface has an adhesion reducing texture.

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